Radiation Safety Check-Off List for Operation of Booster with Ions from EBIS

(for operation beginning 30 September 2013)

September 20, 2013

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Ions from EBIS may be injected and accelerated in Booster only upon completion of this check-off list. Completion of this list does not allow for the injection of Ions from Tandem or for the injection of Protons from Linac.
Before proceeding with the numbered check-off items, the LTB, TTB, and ETB Beamstops must be Inserted, Locked, and Tagged. If necessary, equivalent devices and/or procedures may be substituted with appropriate LP and RSC approval. The Beamstop Locks and Tags are as follows:
1 (LPB) LOTO Linac-To-Booster (LTB) Beamstop Enable Key-Switch (in Building 914):
Tag Number 5014
Lock Number 10L240
Person/Date: Chris Gardner 28 June 2013
2 (LPB) LOTO Tandem-To-Booster (TTB) Beamstop Enable Key-Switch (in Building 914):
Tag Number 5015

	Person/Date: Chris Gardner 28 June 2013
3	(LPB) LOTO EBIS-To-Booster (ETB) Beamstop Enable Key-Switch (in Building 914):
	Tag Number 5016
	Lock Number 0765
	Person/Date: Chris Gardner 28 June 2013
$Th\epsilon$	e following items are to be initialed as complete:
1	Security System
1	(ACG) Functional Test of the Booster access control system complete.
2	(ACG) Functional Test of Booster Extraction interlocks complete.
3.	(ACG) Functional Test of Booster-NSRL Penetration Stub interlocks complete. (These interlocks ensure that the stub region cannot be entered with beam in Booster.)
4.	(ACG) Booster Shutter to prevent long stored beam installed and operational. (The shutter is located in the B6 straight section downstream of the dump.)
5.	(ACG) B6 Dump cooling water flow-switch interlock operational. (This interlock closes the LTB, TTB, and ETB beam stops if water flow ceases.)
6.	(ACG) D3 Septum Magnet cooling water flow-switch interlock operational. (This interlock closes the LTB, TTB, and ETB beam stops if water flow ceases.)
7.	(RSCC) Active temporary changes or bypasses for Booster have been reviewed. (RSC item CK-FY2009-Booster-559.) (ACG)

Lock Number 10L222

	8.		ACG) Any active bypasses have been discussed with the llowed with protons from Linac.
	9.		ACG) Orange tags on critical devices (LTB, TTB, and astops) have been checked.
		(.	LE) Orange tags appropriately located on devices.
2		Shieldin	ıg
	1.	(LE) The Booster berm shielding has been inspected.
	2.		LE) The inspections of the B6 soil cap and the cap at the f the Booster and NSRL are current.
	3.	(]	LE) Booster F6 Septum shielding in place.
	4.	tunnel com	LE) Walk-through inspection of shielding inside Booster uplete.
		(]	LPB)
	5.		LPA) Shielding on AGS side of common boundry between d AGS inspected.
3		Fencing	and Posting
	1.	(]	LE) Booster Perimeter Fence in place.
	2.	Area".	RCD) Booster Perimeter Fence posted as a "Radiation
	3.	(]	LE) Building 914 roof security fence in place.
	4.	Radiation 2	RCD) Building 914 roof security fence posted as a "High Area".
		place.	LE) Security fence enclosing the area over the BTA line in

6.	(RCD) Security fence enclosing the area over the BTA line posted as a "High Radiation Area".
7.	(LE) Structure covering the three pipes that come through the Booster berm over C1 is in place.
8.	(RCD) The structure over C1 is posted to prohibit entry.
9.	$\underline{\hspace{1cm}}$ (RCD) Top of building 914 plug door posted as a "High Radiation Area".
10.	(RCD) Building 914 posted as a "Radiation Area".
11.	(LE) Vent pipe gratings in the Booster tunnel in Place.
12.	(RCD) In the AGS ring, the Booster/AGS labyrinth must be posted on top as follows, to prohibit personnel from working on top of the labyrinth:
	"WARNING! Working at shield top height prohibited, contact MCR if access is necessary."
13.	(RCD) The gate at the downstream end of NSRL Zone 3 (also known as the Booster-NSRL penetration stub) posted as a "High Radiation Area with Beam in Booster" (with instructions to contact MCR for beam status).
14.	(RCD) NSRL Zone 2 posted.
15.	(LE) Fence in place to prevent entry onto the Booster berm from the stairs at the downstream end of the Linac Building.
	(LPB)
16.	(RCD) This fence (above) posted as a "Radiation Area".
4	Chipmunks
1.	(ACIG) Chipmunk NM060 on top of Building 914 plug door installed and checkout complete. This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.
2.	(ACIG) Chipmunk NM058 in "High Radiation Area" on Booster berm over F6 Septum installed and checkout complete. This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.

	3.	Booster berm over BTA DH2 & 3 installed and checkout complete.
		This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.
	4.	(ACIG) Chipmunks NM133 and NM134 in the Booster-NSRL Penetration Stub are installed and checkout complete. The chipmunk at the penetration headwall (NM134) is set to alarm at 16 and interlock at 20 mr/hour. The chipmunk at the stub gate (NM133) is set to alarm at 1 and interlock at 20 mr/hour. (Note that these chipmunks are disabled when extraction from Booster to NSRL is permitted.)
	5.	——— (ACIG) Chipmunk NM112 on Linac side of EBIS-Booster Penetration installed and checkout complete. This Chipmunk is located at beam height at the penetration headwall close to where the beam pipe enters the wall. It is set to alarm at 2.0 and interlock at 2.5 mr/hour.
	6.	(ACIG) All chipmunks are within their allowed calibration periods.
	7.	(LPB) Location of above chipmunks checked.
5		Booster Extraction to AGS
	1.	LPB) Red Radiation Security Hold Tags have been applied to BTA QV5 power supply and magnet to ensure that the polarity of this quadrupole is not changed. (The quadrupole is wired to be vertically focusing for particles with positive charge).
		Either Item 2 OR Item 3 must be completed:
	2.	(LPA) The AGS is ready to accept beam. OR
	3.	(LPA) Booster Extraction to AGS is LOTO:
		Tag No
		Lock No
		Person/Date:

6 Booster Extraction to NSRL

Either Item 1 OR Item 2	must be	${f e}$ completed:
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	1.	(LPN) NSRL (R-line) is ready to accept beam.
		OR
	2.	(LPN) Booster Extraction to NSRL is LOTO:
		Tag No
		Lock No.
		Person/Date:
	1.	(RSCC) Protection from Booster faults in place for the HEBT-TTB cross-over region. (This is to allow ongoing work to proceed in this area during operation of Booster with ions from EBIS.)
8		Sweeps
	1.	(MCR) Area over BTA swept and locked.
	2.	(MCR) Booster Berm swept and locked.
	2	(MCR) Reactor swent and looked

Verification and Permission

All of the above check-off items have been initialed as complete.
(OC)
(Date/Time)
The RS LOTO(s) that prevent EBIS ions from entering Booster may be removed. The ETB beamstop remote enable key (in Bldg. 914) may be inserted and turned (or equivalent devices enabled) to allow beam enable from the MCR.
$\underline{\hspace{1cm}}$ (LPB)
$\underline{\hspace{1cm}} \hspace{1cm} (\mathrm{Date}/\mathrm{Time})$
Abbreviations
LPA = Liaison Physicist AGS (Haixin Huang or designee)
LPB = Liaison Physicist Booster (Chris Gardner or designee)
LPN = Liaison Physicist NSRL (Adam Rusek or designee)
LE = Liaison Engineer (George Mahler or designee)
$\mathrm{CME} = \mathrm{Chief} \; \mathrm{Mechanical} \; \mathrm{Engineer}, \; \mathrm{ME} \; (\mathbf{Joe} \; \mathbf{Tuozzolo} \; \mathrm{or} \; \mathrm{designee})$
RSC = Radiation Safety Committee (Dana Beavis or designee)
RSCC = Radiation Safety Committee Chairman (Dana Beavis)
ACG = Access Control Group (Jonathan Reich or designee)
RCD = Radiation Control Division (Paul Bergh or designee)
ACIG = Accelerator Components and Instrumentation Group (Tony Curcio or designee)
MCR = Main Control Room
OC = Operations Coordinator